Claims

1. A backprojection unit (37) adapted for backprojecting pixel data of n acquired projections (53) onto a voxel sub-volume (58), with n being a natural number, wherein said backprojection unit (37) comprises for each of the n projections:

- voxel center determination means adapted for projecting m contiguous voxels onto a respective one of the projections, with $m \geq 2$ being a natural number, thus obtaining m projected voxel centers (62, 63, 64, 65) per projection;
- memory access means adapted for fetching, for each of the m projected voxel centers, pixel data of pixels adjacent to the projected voxel center from a respective projection buffer (50);
- multiplexing means (70) adapted for distributing the fetched pixel data to m different pipelines (38, 39, 40, 41).

2. The backprojection unit according to claim 1, further comprising n projection buffers, with each of the projection buffers being adapted for storing pixel data of one of the n projections.

3. The backprojection unit according to claim 2, wherein each of the projection buffers comprises at least (2m+2) different memory banks.

4. The backprojection unit according to claim 3, wherein the memory access means are adapted for accessing some of the at least (2m+2) memory banks of the corresponding projection buffer in parallel.

5. The backprojection unit according to claim 1 or any one of the above claims, wherein pixel data of neighboring pixels are stored in different memory banks.

6. The backprojection unit according to claim 1 or any one of the above claims, wherein a respective memory bank a pixel is stored in is selected by means of a multidimensional index, wherein the multidimensional index is derived from the pixel coordinates (x, y).

7. The backprojection unit according to claim 1 or any one of the above claims, wherein a two-dimensional index (u, v) derived from the pixel coordinates (x, y) is used for selecting a respective one of the memory banks.

8. The backprojection unit according to claim 7, wherein, for m = 4, the two-dimensional index (u, v) is determined as (u, v) = (x mod 5, y mod 2).

9. The backprojection unit according to claim 1 or any one of the above claims, wherein at least one of the pipelines comprises:

- pixel data interpolation means adapted for performing a bilinear interpolation of the pixel data of pixels adjacent to a respective projected voxel center, in order to obtain an interpolated pixel value at the respective projected voxel center.

10. The backprojection unit according to claim 9, wherein at least one of the pipelines further comprises:

- a weighting unit adapted for weighting the interpolated pixel value at the projected voxel center with the inverse square of the distance between voxel and source, in order to obtain a weighted pixel value at the projected voxel center.

11. The backprojection unit according to claim 10, wherein at least one of the pipelines further comprises:

- an adder unit adapted for adding the weighted pixel value at the projected voxel center to voxel data of the corresponding one of the m contiguous voxels.

12. The backprojection unit according to claim 11, wherein the weighted pixel values are added to the contents of storage cells that belong to m different shift registers.

13. The backprojection unit according to claim 1 or any one of the above claims, wherein voxel data of the m contiguous voxels is stored in storage cells of m shift registers, said shift registers being adapted for accumulating the contributions of the n projections.

14. The backprojection unit according to claim 12 or claim 13, wherein each of the m shift registers comprises n storage cells that correspond to the n different projections.

15. The backprojection unit according to claim 12 or any one of the above claims, wherein, after voxel data stored in the m shift registers has been updated, the contents of the shift registers are shifted by one position in order to consecutively process the contributions of the n different projections.

16. The backprojection unit according to claim 1 or any one of the above claims, wherein the voxel subvolume is a slice of a voxel volume.

17. The backprojection unit according to claim 16, wherein the slices are oriented perpendicular to an axis of rotation that has been used for acquiring the projections.

18. The backprojection unit according to claim 1 or any one of the above claims, wherein a voxel volume is initially segmented into a plurality of columns, with each voxel subvolume being a slice of a respective column.

19. The backprojection unit according to claim 1 or any one of the above claims, wherein the backprojection unit is implemented as a hardware unit, in particular by means of a Field Programmable Gate Array (FPGA).

20. A method for backprojecting pixel data of n acquired projections (53) onto a voxel subvolume (58), with n being a natural number, the method comprising the following steps that are carried out for each of the n projections:
- projecting m contiguous voxels onto a respective one of the projections, with $m \geq 2$ being a natural number, thus obtaining m projected voxel centers (62, 63, 64, 65) per projection;
- fetching, for each of the m projected voxel centers, pixel data of pixels adjacent to the projected voxel center from a respective projection buffer (50), and
- distributing the fetched pixel data to m different pipelines (38, 39, 40, 41).

21. The method according to claim 20, wherein the pixel data of the n projections are stored in n separate projection buffers.

22. The method of claim 20 or claim 21, wherein the step of fetching comprises accessing at least some of the at least (2m+2) memory banks in parallel.

23. The method of any of claims 20 to 22, further comprising a step of selecting a respective memory bank by means of a multidimensional index that is derived from the pixel coordinates (x, y).

24. The method of any of claims 20 to 23, further comprising a step of selecting a respective memory bank by means of a two-dimensional index (u, v) that is derived from the pixel coordinates (x, y).

25. The method of any of claims 20 to 24, further comprising a step of performing a bilinear interpolation of the pixel data of pixels adjacent to a respective projected voxel center, in order to obtain an interpolated pixel value at the respective projected voxel center.

26. The method of claim 25, further comprising a step of weighting the interpolated pixel value at the projected voxel center with the inverse square of the distance between voxel and source, in order to obtain a weighted pixel value at the projected voxel center.

27. The method of claim 26, further comprising a step of adding the weighted pixel value at the projected voxel center to voxel data of the corresponding one of the m contiguous voxels.

28. The method of any of claims 20 to 27, further comprising a step of accumulating the contributions of the n projections by means of m shift registers, whereby each of the m shift registers comprises n storage cells that correspond to the n different projections.

29. The method of claim 28, further comprising a step of shifting the contents of the m shift registers by one position, after voxel data stored in the m shift registers has been updated, in order to consecutively process the contributions of the n different projections.

30. The method of any of claims 20 to 29, Wherein slices of a voxel volume are chosen as voxel subvolumes, with the slices being oriented perpendicular to an axis of rotation that has been used for acquiring the projections.

31. The method of any of claims 20 to 30, further comprising a step of initially segmenting a voxel volume into a plural-

ity of columns, with slices of said columns being chosen as voxel subvolumes.

32. The method of claim 31, wherein a separate backprojection is performed for each slice of the column.

33. Computer program product, comprising computer program means adapted to embody the features of the backprojection unit as defined in anyone of claims 1 to 18 when said computer program product is executed on a computer, digital signal processor, or the like.

34. Computer program product, comprising computer program means adapted to perform the method steps as defined in anyone of claims 20 to 32 when said computer program product is executed on a computer, digital signal processor, or the like.